Effective energy management tools: inventory management and monitoring of energy consumption by personnel

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Abstracts. This article introduces an innovative management system for retail businesses, based on modern computer vision and data analytics technologies. The primary focus is on effective energy management: optimizing inventory control and monitoring employee energy consumption. The system is designed to address several key challenges faced by stores and trading companies. It provides a comprehensive solution for employee monitoring, utilizing computer vision for automated attendance tracking and establishing a detailed absence database. This streamlines supervisory responsibilities and ensures fair payroll distribution, eliminating unjustified payouts for absenteeism. Furthermore, the system revolutionizes inventory management by offering accurate sales statistics through automated data entry and in-depth analytics. It identifies popular items and forecasts future needs, optimizing procurement decisions and preventing losses due to stock shortages.

1 Introduction

The problem of employee supervision. In many stores supervisors are responsible for this, in order to reduce their workload and improve the productivity of the working staff. The system itself will observe and with the help of computer vision will send a notification that an employee is absent, then this absence will be entered into a database, on the basis of which the system will form a salary and work schedule. This should optimize the schedule. It should also solve the problem of unfair wage payments, now you can't get paid for doing nothing. This will improve the atmosphere in the team, because there will be no unfairness [1-10].

Also, another problem is the accounting of goods, not to count and do not waste time and resources for the consumption of goods, the program will automatically enter it, and will calculate statistics, on the basis of which will be calculated profit, loss.

The problem with the definition of popular goods. This problem will always be relevant everywhere, because everyone needs profit, not to work at a loss. The system will forecast popular goods. Due to this, the institution will buy a sufficient amount of it.

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Commodity managers do not have time to go around and view all the shelves in large stores, from this it follows that some goods are over on the shelves. The lack of goods causes losses, as the customer will not be able to buy what is not there [11-16].

2 System purpose and requirements for the structure and operation of the system

"Observer" is designed to:

- receiving and processing information about employees at the workplace;
- automatic compilation of work schedule;
- compiling the payroll of each employee;
- providing operative notification of employee's absence;
- providing prompt notification of low or no stock on the shelf;
- compiling statistics on sales;
- predicting the goods and their quantity worth buying in a particular period.
- automating the generation of all kinds of reports related to
- production at the enterprise.

"Observer" is to be implemented using PostgreSQL in the form of seven subsystems [17-26]. The architecture of the system is presented in Figure 1.

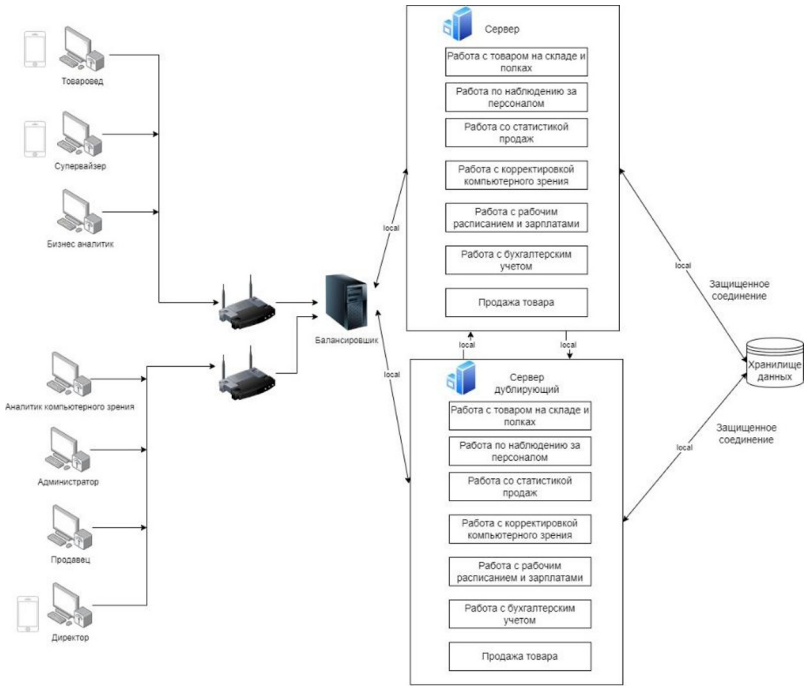

Fig. 1 – System Architecture

Users of the Observer are:

- director;
- administrator;
- computer vision analyst;
- business analyst;

- supervisor;
- merchandiser;
- salesperson.

Users of the Supervisor system must:

- have PC skills as a user;
- know the principles of working with OS Linux, Windows 7 and higher;
- have skills in working with Android or IOS smartphones.

The following figures will demonstrate a prototype of the software interface.

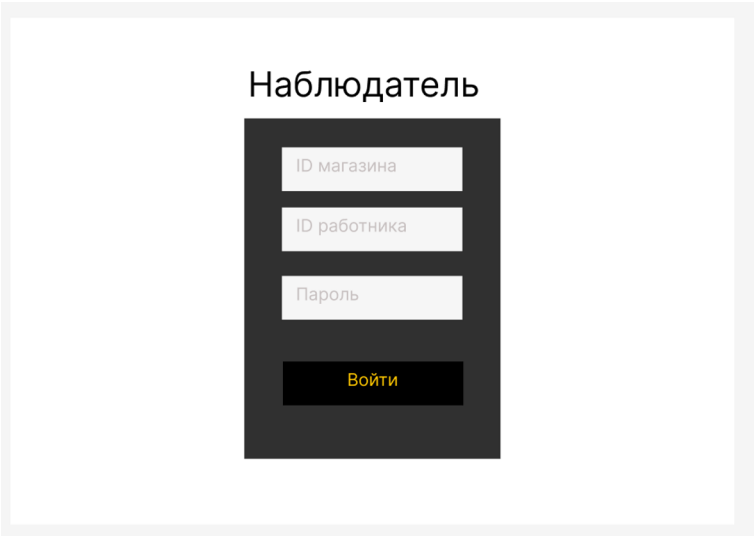

Fig. 2 – Login page layout

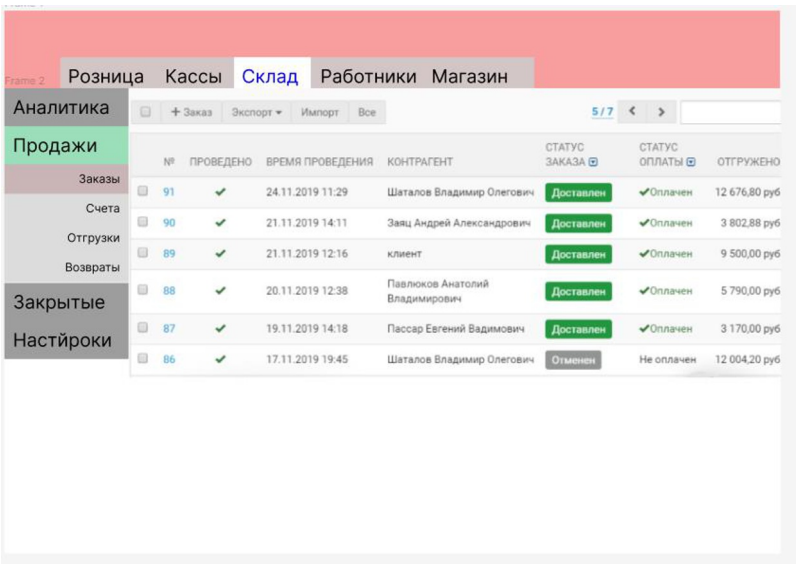

Fig. 3 – Layout of the warehouse tab

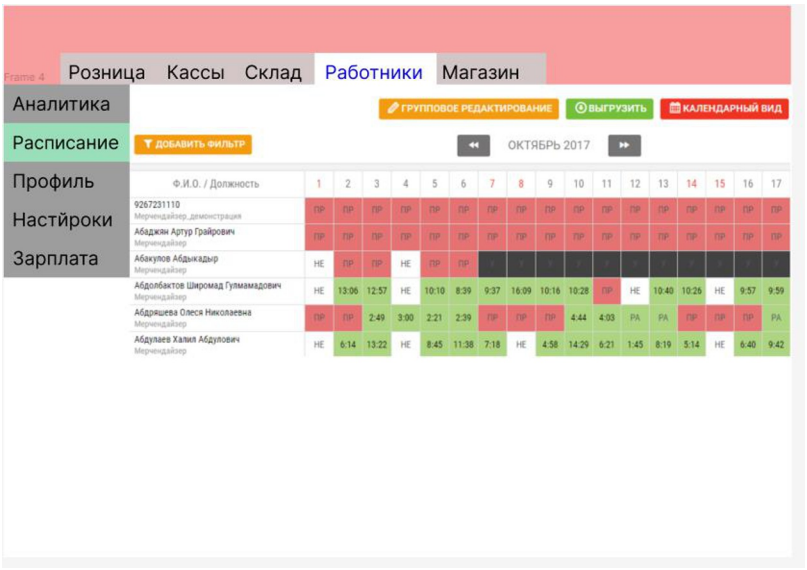

Fig. 4 – Layout of the employee tab

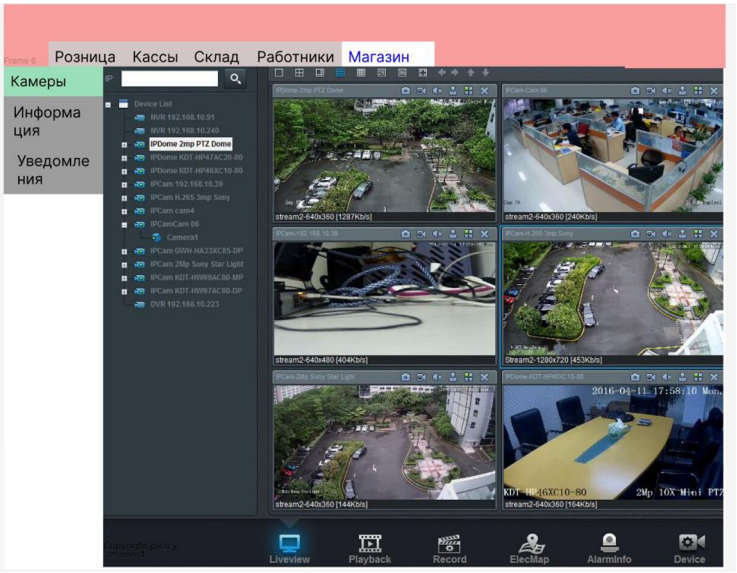

Fig. 5 – Store tab layout

3 Use cases and requirements for the composition and content of work to prepare the automation object for system commissioning

The Observer shall implement the functions shown in the use case diagram below. This diagram is presented in Figure 6.

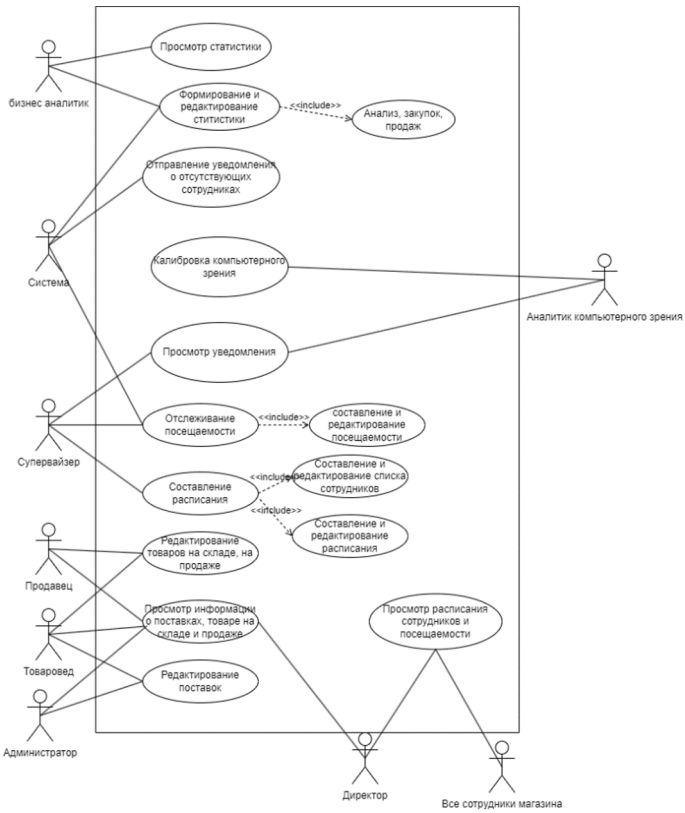

Fig. 6 – Use case diagram

To prepare the software for commissioning it is necessary to:

- appoint an official in the customer's organization responsible for system acceptance;
- to install a set of technical means, meeting the requirements of the relevant ToR, on the workplaces of the employees of the customer's organization, who are to participate in the operation of the software;
- together with the contractor to install the system software in accordance with the administrator's manual;
- to carry out data entry of the reference information and system configuration in accordance with the installation manual of the po;
- to draw up the document "test program" together with the contractor;
- conduct tests in accordance with the document "test program";
- if the result of tests is satisfactory - sign the act of technical readiness of the system for pilot operation. if there are any remarks, issue the document "list of suggestions and remarks for finalization of the system";
- to train potential users in the basics of computer literacy, if necessary;
- to train potential users to work with the software in the scope of the user manual.

4 Problems of implementation

The implementation of this system may encounter difficulties with integration with existing enterprise systems, lack of staff training for the new system, problems with data migration

and storage, as well as data security issues and resistance to change on the part of employees. Technical failures and the need to provide regular updates and support may also be caused by the implementation of the system.

5 Results

The ready-made software will send notifications so that the goods are replenished on the shelves on time. Customers will always buy it up, there will be no time when the product will be missing on the shelf.

Also, the automated employee absence tracking will send out notifications that an employee is out and needs to be substituted, this will also have a positive impact on the store. It will still calculate employee paychecks honestly, if employees are slacking it will affect their paychecks, employee productivity will increase.

Managers will no longer need to keep employee information on paper, this will increase their organization. Also, it will not be necessary to make a working schedule all the time, it will be quick and convenient to adjust it.

The application's statistics system will allow you to graphically interpret information about sales.

Forecasting on the basis of statistics will increase the success of purchasing and selling goods.

6 Conclusion

The introduction of an employee monitoring system using computer vision seems to be a promising step to optimize the workflow and improve the atmosphere in the team. Automated goods accounting and forecasting of popular products will minimize the risks of shortage of goods on the shelves and improve procurement planning, which will ultimately lead to higher profits of the institution.

The proposed solutions involve reducing unfair wage payments by accurately recording employee time and activity, which helps incentivize employees to be more responsible and productive. Also, the automation of goods accounting will help to optimize costs and increase the efficiency of merchandisers, reducing the likelihood of shortage of goods on the shelves and minimizing losses from downtime.

However, it is worth bearing in mind that implementing such a system requires careful planning and robust data protection to prevent potential misuse and breaches of confidentiality. In addition, it is important to provide training to employees and merchandisers to ensure the successful implementation and effective use of the new system.

References

1. B. V. Malozyomov et al. Energies **13,** 4907 (2023)
2. B. V. Malozyomov Micromachines **7**, 1288 (2023)
3. D. M. Strateichuk et al. Crystals **5**, 825 (2023)
4. V. O. Gutarevich et al. Applied Sciences **8**, 4671 (2023)
5. I. I. Bosikov et al. Fire **3,** 95 (2023)
6. B. V. Malozyomov et al. Energies **9,** 3909 (2023)
7. B. V. Malozyomov, et al. Energies **11**, 4276 (2023)

8. K. Moiseeva et al. *The Impact of Coal Generation on the Ecology of City Areas,* 2023 22nd International Symposium INFOTEH-JAHORINA (INFOTEH), 1-6 (2023)
9. V. Kukartsev et al. *Analysis of Data in solving the problem of reducing the accident rate through the use of special means on public roads,* 2022 IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS), 1-4 (2022)
10. T. Kireev et al. *Analysis of the Influence of Factors on Flight Delays in the United States Using the Construction of a Mathematical Model and Regression Analysis,* 2022 IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS), 1-5 (2022)
11. V. Kukartsev et al. *Prototype Technology Decision Support System for the EBW Process,* Proceedings of the Computational Methods in Systems and Software. – Cham: Springer International Publishing, 456-466 (2022)
12. V. Kukartsev et al. *Methods and Tools for Developing an Organization Development Strategy,* 2022 IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS), 1-8 (2022)
13. I. Othman, et.al., Buildings **13** (2023)
14. E.O. Alohan, et.al., Buildings **13** (2023)
15. J. Hunt, et.al., Buildings **13** (2023)
16. I. S. Masich, et.al., Computation, **10(10),** 185 (2022)
17. A. S. Mikhalev, et al. Symmetry **14.10,** 2036 (2022)
18. I. S. Masich, et.al., Electronics **11(24),** 4150 (2022)
19. V. V. Bukhtoyarov et al. Electronics **12**, 1, 215 (2023)
20. I. A. Barantsov, et al., Sensors **23**, 2, 582 (2023)
21. E A Kosenko and V A Nelyub, Sci. - Ser. D **15,** 240–4 (2022)
22. V A Nelyub and I A Komarov, Russ. Metall. **202113,** 1696–9 (2022)
23. V A Nelyub, et.al., Fibre Chem. **534**, 53, 252–7 (2022)
24. M A Orlov, et.al., J. Phys. Conf. Ser. **1990**, 012042 (2021)
25. V A Nelyub, J. Phys. Conf. Ser. **1990,** 012071 (2021)
26. V.A. Lomazov, et.al., IOP Conference Series: Earth and Environmental Science **981(2)** (2022)